REMARKS

Reconsideration of this application, based on this amendment and these following remarks, is respectfully requested.

Claims 1 and 3 through 14 remain in this case. Claim 13 is amended.

Claim 13 was objected to because its dependency was unclear. Claim 13 is amended as suggested by the Examiner, to clarify that it depends on claim 1.

Claims 1 and 8 were rejected under §103 as unpatentable over the Morishige et al. reference[1] in view of the Rebeiz et al. reference[2]. The Examiner asserted that the Morishige et al. reference teaches all of the elements of the claim, except for mixers receiving a first local oscillator signal that has a frequency equal to the center frequency of the transmitter section or a sub-harmonic thereof.[3] However, the Examiner asserts that the Rebeiz et al. reference teaches such a local oscillator signal at such a frequency, and that it would have been obvious to combine these teachings with those of the Morishige et al. reference "to better reduce the interference in the radio".[4] The claims were rejected accordingly.

Applicant respectfully traverses the §103 rejection of claim 1 and its dependent claims, on the grounds that the combined teachings of the references fall short of the requirements of the claims.

Claim 1 is directed to an FDD radio having a transmitter section that transmits in a transmit frequency band having a center frequency, and having a receiver section for receiving a signal in a receive frequency band that is non-overlapping relative to the transmit frequency band. In other words, because the radio of claim 1 is a frequency-division duplexed (FDD) radio, its transmit frequency band is by definition not the same as its receive frequency band.

---

[1] U.S. Patent No. 6,600,911 B1, issued July 29, 2003 to Morishige et al.
[2] U.S. Patent No. 6,348,830 B1, issued February 19, 2002 to Rebeiz et al.
[3] Office Action of April 5, 2006, page 3, §2.
[4] Office Action, *supra,* page 3, §2, *citing* Rebeiz et al., *supra,* column 7, lines 18 through 36, and Figure 11.

Claim 1 further requires that the receiver section comprise a first down conversion section comprising first and second mixers, each receiving a first local oscillator (LO) signal having a frequency equal to the center frequency of the transmit frequency band or a sub-harmonic thereof. And, as stated above, the center frequency of the transmit frequency band, upon which the receiver LO signal frequency is based, therefore does not correspond to the RF receive frequency, because the radio of claim 1 is an FDD radio.

As discussed in the specification, the invention of claim 1 provides important advantages over conventional FDD transceiver radios, including the elimination of interference from the strongest interference source without requiring expensive surface acoustic wave (SAW) type filters, which cannot be readily integrated into the radio integrated circuit.[5] The transmit interference is eliminated because of the selection LO frequency in the receive down-converter, as this causes the transmit signal interference signal to be converted to DC, and easily filtered from the resulting receive signal.[6]

As noted above, the Examiner bases the §103 rejection on a finding that the Rebeiz et al. reference teaches mixers in a receiver that receive a local oscillator signal at the center frequency of the transmit band or a sub-harmonic thereof, such teachings absent in the Morishige et al. reference. However, Applicant respectfully submits that the Rebeiz et al. reference discloses no such feature.

The location of the Rebeiz et al. reference cited by the Examiner provides no teaching whatsoever regarding the frequency of the local oscillator signal in the disclosed subharmonic double-balanced mixer. For the convenience of the reader, the cited location of the reference is provided in its entirety here:

> FIG. 11 shows a conceptual drawing of the subharmonic double-balanced mixer of the present invention with four LO drives. FIG. 12 shows a simplified schematic of the first embodiment of the subharmonic double-balanced mixer of the present invention. For simplicity, biasing details are not shown in FIG. 12. The LO section consists of transistors Q1, Q2, Q3 and Q4. The bases of the

[5] *See* specification of S.N. 09/785,759, page 5, lines 9 through 16.
[6] Specification, *supra,* page 3, lines 10 through 14.

> transistors Q1 and Q2 are coupled to the first LO differential signal formed by the first and second LO drive signals (0°-180°). The bases of the transistors Q3 and Q4 are coupled to the second LO differential signal formed by the third and fourth LO drive signals (90°-270°). The second LO differential signal is 90° out of phase with the first LO differential signal. The emitters of Q1, Q2, Q3 and Q4 are connected together to a biasing current source, I_{bias}. The collectors of Q1 and Q2 are connected together to form a doubling pair. The sum of the collector currents of Q1 and Q2, denoted as I_{C12} as shown in FIG. 12 depends on the LO differential signal and has a frequency twice that of the LO signal.[7]

It is evident from this cited location of the reference that there is no mention whatsoever of the frequency of the disclosed LO signals. Accordingly, Applicant respectfully submits that the basis of the §103 rejection as stated in the Office Action is in error.

Of course, one could reasonably surmise that the Rebeiz et al. reference must disclose *some* frequency for its LO signals, and indeed it does. The Rebeiz et al. reference teaches the selection of the local oscillator frequency for a subharmonic double-balanced mixer (*i.e.,* such as the mixer referred to in the cited location), as a frequency that is "approximately half that of the RF signal"[8] The Rebeiz et al. reference also teaches several examples of its LO frequency. For an incoming RF frequency of 1900 or 2400 MHz, a 915 MHz LO frequency is suggested,[9] and for an incoming RF frequency of 1960 MHz with a bandwidth of 1 MHz, the suggested LO frequency is 980 MHz.[10] While these frequencies are mentioned in connection with the background of the Rebeiz et al. reference, there are no other frequencies mentioned in the portion of the Rebeiz et al. reference directed to its own invention.

Therefore, to the extent that the Rebeiz et al. reference mentions the selection of its local oscillator frequencies, the selected frequencies are each selected based on the RF frequency of the incoming signal. For each of the examples discussed above, the local oscillator frequency is selected to provide a particular intermediate frequency, and as such the local oscillator frequency depends on the incoming RF frequency. Nowhere does the Rebeiz et al. reference anywhere mention the selection of a receiver-side local oscillator frequency to correspond to the center

[7] Rebeiz et al., *supra,* column 7, lines 18 through 36.
[8] Rebeiz et al., *supra,* column 3, lines 2 through 4.
[9] Rebeiz et al. *supra,* column 3, lines 6 through 9.

frequency of the transmit frequency band of an FDD transmitter in the same transceiver, or a subharmonic thereof, as required by claim 1. Instead, the local oscillator frequency in the Rebeiz et al. reference is selected based on the RF frequency of the incoming signal.

For these reasons, Applicant respectfully submits that the Rebeiz et al. reference does not teach what the Examiner found it to teach. Applicant therefore respectfully submits that the rejection of claim 1 is in error, and that the combined teachings of the Morishige et al. and Rebeiz et al. references fall short of the requirements of amended claim 1.

Furthermore, considering the important advantages provided by the invention of claim 1, such advantages including the suppression of interference caused by the transmitter section of the radio, at a different frequency from that of the incoming RF signal, stem directly from the difference between the claimed apparatus and the prior art. Applicant therefore respectfully submits that these advantages indicate the lack of suggestion from the prior art to modify the teachings of the asserted references against claim 1, and that these advantages further support the patentability of claim 1 and its dependent claims over the prior art.

Claims 3 through 7 and 13 directly or indirectly depend on claim 1. These claims were rejected as unpatentable over the Morishige et al. and Rebeiz et al. references, as applied against claim 1, in view of the Tolson et al. reference[11]. The Tolson et al. reference was applied against these claims as teaching various implementations of high pass filters.

Applicant respectfully submits that the combined teachings of these references fall short of the requirement of amended claim 1 and all of its dependent claims. As mentioned above, the Morishige et al. and Rebeiz et al. references both fail to disclose a mixer in a receiver that receives a local oscillator signal having a frequency equal to the center frequency of a transmitter section or a sub-harmonic thereof, as claimed. The Tolson et al. reference fails to add any teachings, expressly or inherently, regarding this local oscillator frequency. Accordingly, Applicant respectfully submits that the combined teachings of the Morishige et al., Rebeiz et al.,

[10] *Id.*, at column 3, lines 46 through 49.

and Tolson et al references necessarily fall short of the requirements of amended claim 1, and therefore fall short of the requirements of its dependent claims 3 through 7 and 13.

Applicant further submits that there is no suggestion from the prior art to modify these teachings in such a manner as to reach the requirements of amended claim 1, much less any of its dependent claims. This lack of suggestion is even more evident considering the important advantages provided by the invention of claim 1 that include, among others, the elimination of interference from the strongest interference source without requiring expensive surface acoustic wave (SAW) filters, which cannot be readily integrated into the radio integrated circuit.[12] These advantages stem directly from the difference between the claimed apparatus and the prior art, and as such further support the patentability of amended claim 1 and its dependent claims over the prior art.

For these reasons, Applicant submits that the invention of claim 1 and its dependent claims 3 through 7, and 13 are patentably distinct over the applied references.

Claim 8 was also rejected under §103 as unpatentable over the combination of the Morishige et al. and Rebeiz et al. references, for the same reasons as applied against claim 1. Dependent claims 9 through 12 were also rejected under §103 as unpatentable over the Morishige et al. and Rebeiz et al. references, in view of the Tolson et al. reference, on similar grounds as applied against the claims dependent on claim 1.

Applicant respectfully traverses the rejection of claims 8 through 12, on the grounds that the rejection is in error, and that the combined teachings of the applied references fall short of the requirements of the claims.

Similarly as claim 1, claim 8 expressly recites that the transmit signal produced by the transmit section of an FDD radio is in a transmit frequency band having a center frequency, and that its recited method is directed to minimizing interference caused by that transmit signal on a

---

[11] U.S. Patent No. 6,625,436 B1, issued September 23, 2003 to Tolson et al., and having a filing date of July 28, 2000.

[12] *See* specification of S.N. 09/785,759, page 5, lines 9 through 16.

signal received by the receiver section of the radio, at a receive frequency that differs from the transmit band center frequency. The method of claim 8 requires the providing of a local oscillator (LO) signal to a first down conversion section of the receiver, at a frequency equal to the transmit band center frequency or a sub-harmonic thereof. As discussed above, because the radio is an FDD radio, and as expressly recited in the claim, the transmit band center frequency differs from the receive frequency.

Both the Examiner and Applicant agree that the Morishige et al. reference does not disclose a receive mixer that receives a local oscillator signal at a transmit band center frequency. However, Applicant submits that the Rebeiz et al. reference also lacks teachings in this regard. The location of the reference cited by the Examiner does not mention the frequency of the local oscillator.[13] And to the extent that the Rebeiz et al. reference discusses local oscillator frequencies in the receiver (which it discusses in connection with its background), those local oscillator frequencies are all based on the frequency of the incoming RF signal.[14] Accordingly, Applicant submits that the Rebeiz et al. reference does not teach mixers receiving a local oscillator signal having a frequency equal to the transmit band center frequency of a sub-harmonic thereof, as required by claim 8. Applicant therefore submits that the rejection of claim 8 is in error, and that the combined teachings of the Morishige et al. and Rebeiz et al. references in fact fall short of the requirements of the claim.

Applicant further submits that there is no suggestion from the prior art to modify these teachings in such a manner as to reach claim 8. As discussed previously and above in this paper, there is no mention or suggestion from the Morishige et al. and Rebeiz et al. references of providing a local oscillator signal to a down converter in a receiver, at a transmit band center frequency or a sub-harmonic thereof. As mentioned above, the Tolson et al. reference, was applied against dependent claims 9 through 12 as teaching various high pass filter implementations. However, the Tolson et al. reference lacks teachings regarding the providing of a local oscillator signal to a down converter in a receiver, at a transmit band center frequency

[13] *See* Rebeiz et al., *supra,* column 7, lines 18 through 36.
[14] Rebeiz et al., *supra,* column 3, lines 2 through 9, and 46 through 49.

or a sub-harmonic thereof. Accordingly, the Tolson et al. reference fails to disclose or suggest the limitations of claim 8 that are missing from the Morishige et al. and Rebeiz et al. references. In addition, considering that dependent claims 9 through 12 incorporate the limitations of claim 8, upon which they depend, Applicant also submits that the combined teachings of these references also fall short of the requirements of these claims 9 through 12.

In addition, Applicant submits that the important advantages provided by the claimed method, such advantages including the eliminating of interference from the transmit signal; as mentioned above, interference from the transmit signal is converted to DC because the LO frequency in the receive down-converter matches the center transmit frequency or a sub-harmonic thereof.[15] Use of the method of claims 8 through 12 accomplishes this advantage without requiring expensive SAW filters and the like, as in the operation of conventional transceivers. Applicant submits that these advantages further support the patentability of these claims over the prior art.

For these reasons, Applicant traverses the rejection of claims 8 through 12, and submit that these claims are patentably distinct over the applied references.

Claim 14 was also rejected under §103 as unpatentable over the combination of the Morishige et al. and Rebeiz et al. references, in view of the Tolson et al. reference, applied as discussed above. Applicant yet again respectfully traverses the rejection of claim 14.

As argued above relative to claims 1 and 8, Applicant disputes the Examiner's assertion that the Rebeiz et al. reference discloses the mixing of the receive signal with a local oscillator frequency equal to the transmit center frequency or a sub-harmonic thereof, as required by claim 14. Neither at the location cited by the Examiner,[16] nor elsewhere, [17] does the Rebeiz et al. reference disclose any local oscillator frequencies in its receiver that are based on any other frequency than that of the incoming RF signal. Accordingly, Applicant submits that the Rebeiz et al. reference does not teach mixing a receive signal with a local oscillator signal having a

[15] Specification, *supra,* page 3, lines 10 through 14.
[16] *See* Rebeiz et al., *supra,* column 7, lines 18 through 36.

frequency equal to the transmit band center frequency of a sub-harmonic thereof, as required by claim 14. And considering that neither of the Morishige et al. and Tolson et al. references teach such a local oscillator frequency, Applicant submits that the combined teachings of the applied references fall short of the requirements of claim 14. And for the reasons discussed above relative to claims 1 and 8, Applicant submits that there is no suggestion from the prior art to modify these teachings in such a manner as to reach claim 14, especially considering the important advantages provided by the claimed invention.

The §103 rejection of claim 14 is therefore respectfully traversed. Reconsideration is requested.

For these reasons, Applicant respectfully submits that all of the claims in this case are in condition for allowance. Reconsideration of this application is therefore respectfully requested.

Respectfully submitted,

/Rodney M. Anderson/

Rodney M. Anderson

Registry No. 31,939

Attorney for Applicant

Anderson, Levine & Lintel, L.L.P.
14785 Preston Road, Suite 650
Dallas, Texas 75254
(972) 664-9554

[17] *E.g.,* Rebeiz et al., *supra,* column 3, lines 2 through 9, and 46 through 49.